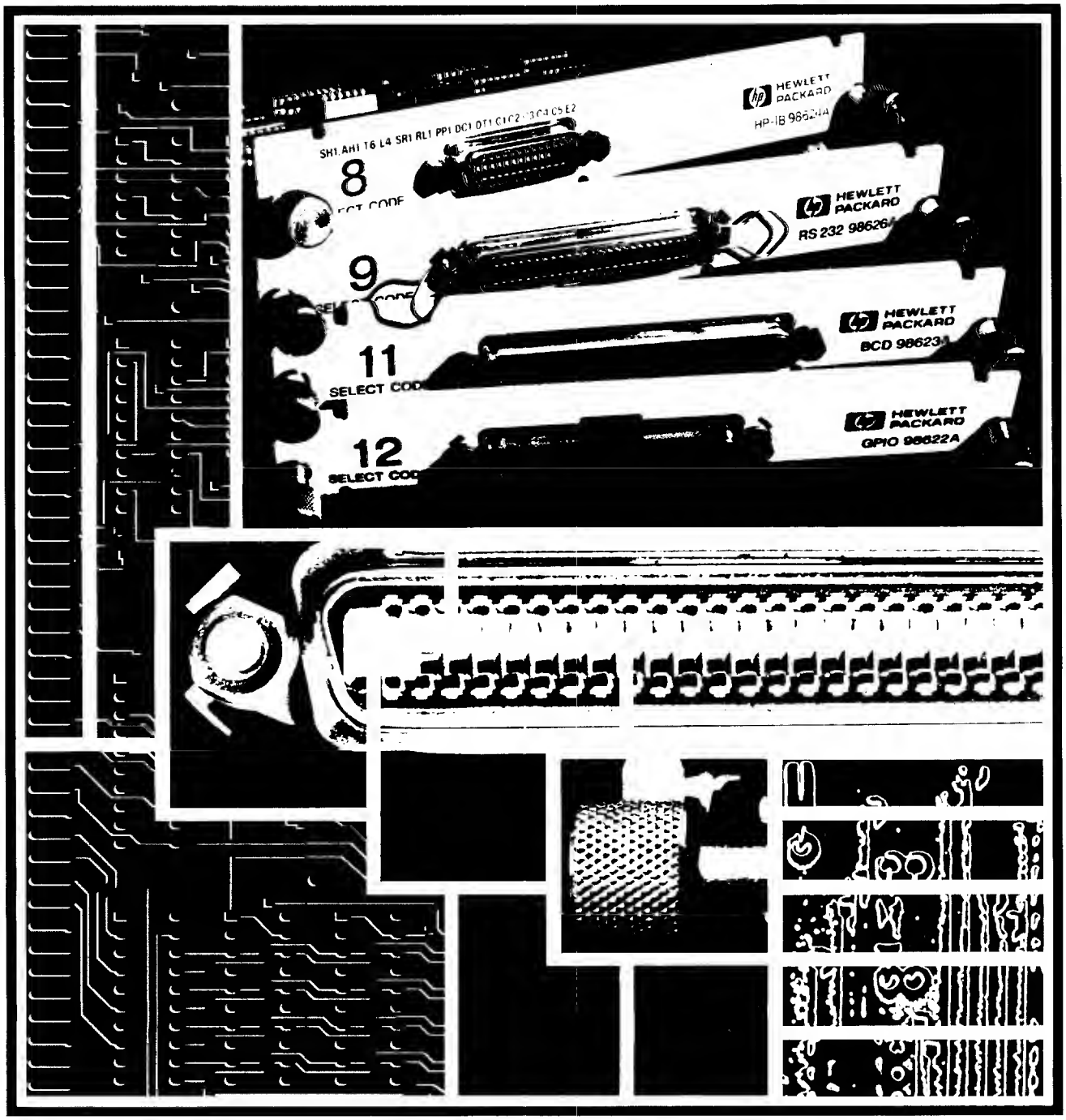
HP 98644A
Asynchronous Serial Interface
Reference Manual



HEWLETT PACKARD

HP DIRECT I/O Computer Systems

HP 98644A
Asynchronous Serial Interface

Reference Manual

Card Assembly Number: 98644-66502

Date Code: A-2505

HEWLETT PACKARD

HEWLETT-PACKARD COMPANY
Roseville Networks Division
8000 Foothills Boulevard
Roseville, California 95678

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PRINTING HISTORY

The Printing History below identifies the Edition of this Manual and any Updates that are included. Periodically, update packages are distributed which contain replacement pages to be merged into the manual, including an updated copy of this Printing History page. Also, the update may contain write-in instructions.

Each reprinting of this manual will incorporate all past updates; however, no new information will be added. Thus, the reprinted copy will be identical in content to prior printings of the same edition with the user-inserted update information. New editions of this manual will contain new information, as well as updates.

First Edition .... March 1985

SAFETY CONSIDERATIONS

GENERAL - This product and relation documentation must be reviewed for familiarization with safety markings and instructions before operation.

SAFETY SYMBOLS

Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the product against damage.

Indicates hazardous voltages.

Indicates earth (ground) terminal (sometimes used in manual to indicate circuit common connected to grounded chassis).

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

CAUTION

STATIC SENSITIVE DEVICES

When any two materials make contact, their surfaces are crushed on the atomic level and electrons pass back and forth between the objects. On separation, one surface comes away with excess electrons (negatively charged) while the other is electron deficient (positively charged). The level of charge that is developed depends upon the type of material. Insulators can easily build up static charges in excess of 20,000 volts. A person working at a bench or walking across a floor can build up a charge of many thousands of volts. The amount of static voltage developed depends on the rate of generation of the charge and the capacitance of the body holding the charge. If the discharge happens to go through a semiconductor device and the transient current pulse is not effectively diverted by protection circuitry, the resulting current flow through the device can raise the temperature of internal junctions to their melting points. MOS structures are also susceptible to dielectric damage due to high fields. *The resulting damage can range from complete destruction to latent degradation.* Small geometry semiconductor devices are especially susceptible to damage by static discharge.

The basic concept of static protection for electronic components is the prevention of static build-up where possible and the quick removal of already existing charges. The means by which these charges are removed depend on whether the charged object is a conductor or an insulator. If the charged object is a conductor such as a metal tray or a person's body, grounding it will dissipate the charge. However, if the item to be discharged is an insulator such as a plastic box/tray or a person's clothing, ionized air must be used.

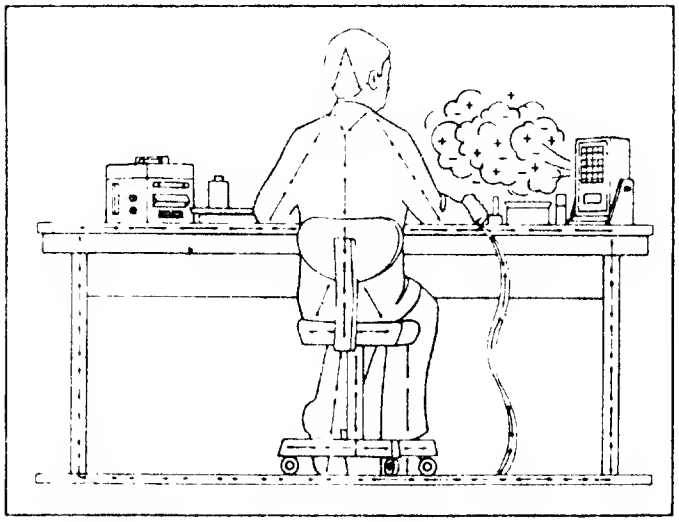
Effective anti-static systems must offer start-to-finish protection for the products that are intended to be protected. This means protection during initial production, in-plant transfer, packaging, shipment, unpacking and *ultimate use.* Methods and materials are in use today that provide this type of protection. The following procedures are recommended:

1. All semiconductor devices should be kept in "antistatic" plastic carriers. Made of transparent plastics coated with a special "antistatic" material which might wear off with excessive use, these inexpensive carriers are designed for short term service and should be discarded after a period of usage. *They should be checked periodically to see if they hold a static charge greater than 500 volts in which case they are rejected or recoated.* A 3M Model 703 static meter or equivalent can be used to measure static voltage, and if needed, carriers (and other non-conductive surfaces) can be recoated with "Staticide" (from Analytical Chemical Laboratory of Elk Grove Village, Ill.) to make them "antistatic."

2. Antistatic carriers holding finished devices are stored in transparent static shielding bags made by *3M Company.* Made of a special three-layer material (nickle/polyester/polyethylene) that is "antistatic" inside and highly conductive outside, they provide a Faraday cage-like shielding which protects devices inside. "Antistatic" carriers which contain semiconductor devices should be kept in these shielding bags during storage or in transit.

Individual devices should only be handled in a static safeguarded work station.

3. A typical static safeguarded work station is shown below including grounded conductive table top, wrist strap, and floor mat to discharge conductors as well as ionized air blowers to remove charge from nonconductors (clothes). Chairs should be metallic or made of conductive materials with a grounding strap or conductive rollers.



SAFETY EARTH GROUND - This is a safety class I product and is provided with a protective earthing terminal. An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and be secured against any unintended operation.

BEFORE APPLYING POWER - Verify that the product is configured to match the available main power source per the input power configuration instructions provided in this manual.

If this product is to be energized via an auto-transformer (for voltage reduction) make sure the common terminal is connected to the earth terminal of the main power source.

SERVICING

WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by qualified personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside this product may still be charged even when disconnected from its power source.

To avoid a fire hazard, only fuses with the required current rating and of the specified type (normal blow, time delay, etc.) are to be used for replacement.

WARNING

EYE HAZARD

Eye protection must be worn when removing or inserting integrated circuits held in place with retaining clips.

PREFACE

This manual describes the HP 98644A Asynchronous Serial Interface card. In particular, it describes card assembly 98644-66502 with a date code of A-2505. Differences between this card and earlier versions of the 98644A interface are described in Section 11 (Product History) of this manual.

The 98644A card is similar in function to the HP 98626A serial interface card. Section 11 of this manual also describes the differences between those two cards.

This manual contains the following sections:

1. General Information
3. Installation
8. Troubleshooting
9. Replaceable Parts
11. Product History
12. Diagrams
A. Programming Information

(The astute reader will have noticed that some section numbers are missing from the above list. That's because this manual conforms to an emerging HP standard for computer service manuals. We have omitted those standard sections that do not apply to the HP 98644A card, but have preserved the standard section numbering for the sections that remain.)

CONTENTS

CONTENTS (continued)

GENERAL INFORMATION

SECTION 1

The HP 98644A card is a low-cost RS-232-C interface that provides asynchronous serial data communications between an HP 9000 Series 200 computer and an external device (typically a terminal, printer, or modem).

This card is similar in function to the HP 98626A serial interface. In most applications the 98644A card can be used in place of the 98626A card. Differences between the two interfaces are described in Section 11 (Product History) of this manual.

EQUIPMENT SUPPLIED

The 98644A product consists of:

1. the serial interface card assembly (98644-66502)
2. this manual (98644-90002)

No tools are needed to install this card.

IDENTIFICATION

The descriptors that identify this card are:

1. Product number	HP 98644A
2. Card assembly number	98644-66502
3. Date code	A-2505

The card assembly number and the date code are printed on the front edge of the upper surface of the card, just behind the cover plate.

Differences between this card and earlier versions of the 98644A card (those with a card assembly number of 98644-66501) are listed in Section 11 (Product History) of this manual. (If you need additional information on the 98644-66501 card, refer to its manual, part number 98644-90001.)

SPECIFICATIONS

Electrical:

The card takes its operating voltages from the computer power supply, through the backplane. Electrical requirements are:

Voltage	Power
+12 V	0.30 W
+ 5 V	2.03 W
-12 V	0.03 W

Total power consumption is 2.36 watts.

Environmental:

Operating environment for this card should conform to the following requirements:

Temperature:	0 - 55 degrees C
Relative Humidity:	5% - 95% at 40 degrees C, non-condensing

Before operating this unit in any extreme environment, consult your HP Customer Engineer or your local HP Sales and Service office.

Physical:

Length:	14.6 cm (5.75 in)
Width:	19.2 cm (7.56 in)
Height:	2.95 cm (1.16 in)
Weight (card only):	0.43 kg (0.94 lbs)
Shipping weight (including packing materials):	1.04 kg (2.29 lbs)

SITE PREPARATION

SECTION 2

There are no site preparation procedures for the HP 98644A card.

INSTALLATION

SECTION 3

Installing the HP 98644A Asynchronous Serial Interface card consists of these operations:

1. Unpacking the card.
2. Setting switches.
3. Inserting the card into the backplane.
4. Attaching the appropriate cable.
5. Testing the card.

These operations are described in detail in the remainder of this section.

UNPACKING THE CARD

Please follow the steps listed below to protect the hardware and to preserve your rights under the laws governing freight shipments.

1. Read the "Safety Considerations" pages at the front of this manual, particularly those portions dealing with static electricity.

CAUTION

The serial interface card contains static-sensitive devices. Use proper anti-static procedures when handling the card.

When you remove the serial interface card from its packing material, handle it by the edges or by the metal cover plate. Do not touch the gold-plated contacts on the back edge of the card. If you do get fingerprints on those contacts, clean them with a lintless tissue moistened with a small amount of isopropyl alcohol.

CAUTION

Never clean the contacts with an abrasive cleaner such as an eraser. Such cleaning may damage the plating on the contacts.

2. Check the contents of the package to verify that you have received the product you ordered. Refer to the descriptions of the Equipment Supplied in Section 1, and to your invoice. If any parts appear to be missing, notify your HP Sales and Service office.

Inspect the contents carefully for hidden damage such as detached components, corrosion, or cracks and dents. Notify the carrier who delivered the product and your HP Sales and Service office if you find any damage. Save the packing material for the carrier. The HP Sales and Service office will arrange for repair or replacement of the card without waiting for the settlement of the claim against the carrier.

SETTING SWITCHES

All of the switches on the serial interface card are contained in one switch pack, SW1. Settings of these switches determine the following:

select code of the card
interrupt level
modem line enabling
98626A emulation
remote keyboard enabling

SW1 contains ten individual slide switches. Figure 3.1 shows the location of SW1 on the serial interface card, along with a detailed drawing of the switch pack itself.

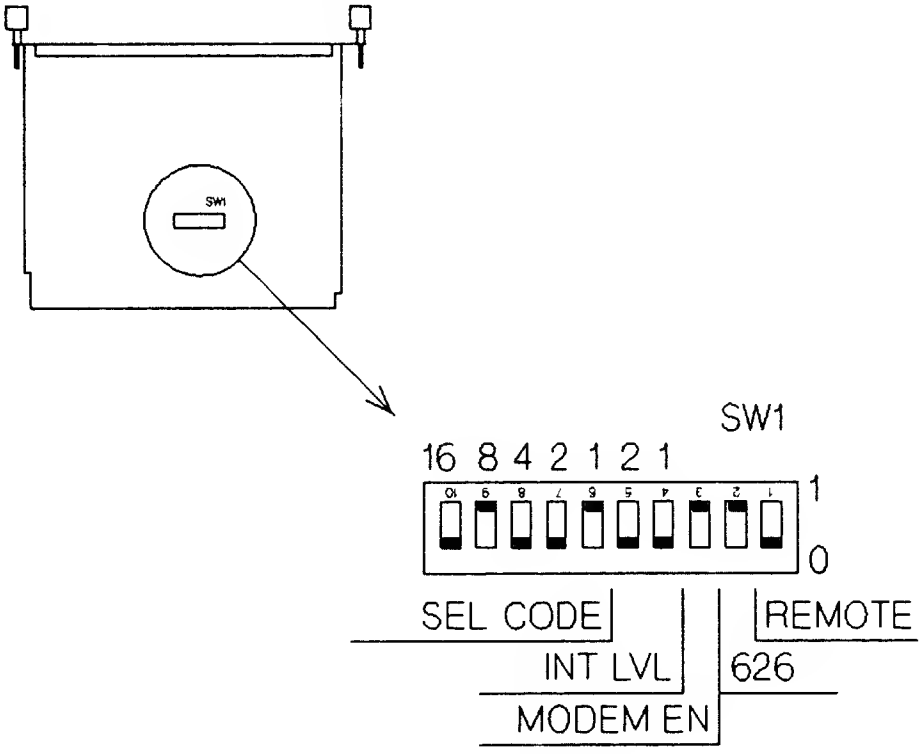


Figure 3-1. Location of SW1

The switch settings shown in the figure are the factory settings. If you want to change any of those settings, use a pointed object (such as the tip of a ball point pen) to slide the switch to the opposite position.

Meanings of the switches are:

Switch	Factory Setting	Description
6-10	9	**Select Code.** This is a binary number that sets the select code of the card. Make sure that no two cards in your computer have the same select code.
4&5	3	**Interrupt Level.** This is a binary number that sets the interrupt level of the card. The switch settings and their corresponding numbers are: 00 = Level 3 01 = Level 4 10 = Level 5 11 = Level 6
3	1	**Modem Line Enable.** This switch setting has the following meaning: 0 straps CTS, DSR, RI, and CD low (true) 1 allows CTS, DSR, RI, and CD to be activated by pins 5, 6, 8, and 22 (respectively) on the connector.
2	1	**98626A Emulation.** If this switch is set to 1, the secondary ID of the card is 2. This is the standard secondary ID assignment for the 98644A card. If this switch is set to 0. the secondary ID becomes 0, which is the standard secondary ID assignment for a 98626A card. Earlier versions of some operating systems expect a 98626A card, and setting this switch to 0 will satisfy that expectation. The appropriate settings are:
1	0	**Remote Keyboard Enable.** This switch enables a remote keyboard. 0 = remote keyboard disabled 1 = remote keyboard enabled

	Version 2.0	2.1	3.0
Pascal	0	0	1
BASIC	1	1	1
HP-UX	0	1	n/a

In addition, existing application software written for a 98626A may require a secondary ID of 0. Refer to Section 11 (Product History) of this manual for a list of the differences between the 98644A card and the 98626A card.

Once you have set the switches, you are ready to insert the card into the backplane.

INSERTING THE CARD

To insert the card into the backplane of your computer, do the following:

1. Turn the computer's power OFF.

2. Find an empty I/O slot. The I/O slots are the odd-numbered slots (counting from the bottom) in your computer's backplane. Remove the metal backplane covers one by one, until you find an empty I/O slot. (You may be able to free up an I/O slot by moving around your memory and DMA cards. Memory and DMA cards can be placed in any slots, whereas I/O cards are restricted to the odd-numbered slots.)

3. Slide the card into the slot until the back edge of the card comes into contact with the backplane connectors. Tighten the thumbscrews on the cover plate until the card is firmly seated. (Tighten the thumbscrews only finger tight; DO NOT use a wrench, as this may strip the threads.)

4. Don't turn the computer power back on until you have connected the cable (see below).

ATTACHING A CABLE

Attach the appropriate cable from the serial interface card to your peripheral device. The list below gives the recommended cables for the 98644A card.

Cable #	Length	Card End	Peripheral End	Typical Use
13222Y	5m	25-pin male	50-pin	262X terminals
13232Y	4.5m	25-pin male	edge connector	264X terminals
13242N	5m	25-pin male	25-pin male	modems
13242G	5m	25-pin male	25-pin male	2601A printer, other terminals

Note that the RS-232-C standard recommends a maximum cable length of 15 meters (50 feet).

Pin assignments for the 25-pin female connector on the 98644A card are given in Section 12 (Diagrams) of this manual.

TESTING THE CARD

After the card is installed in the computer and the cable is connected, you can verify the proper functioning of the card by running its system functional test. The system functional test is available separately; refer to Section 8 (Troubleshooting).

PREVENTIVE MAINTENANCE

SECTION 4

There are no preventive maintenance procedures for the HP98644A card.

FUNCTIONAL DESCRIPTION

SECTION 5

There is no functional description for the HP 98644A card.

Register maps and schematic diagrams are provided in Section 12 (Diagrams) of this manual.

REMOVAL AND REPLACEMENT

SECTION 6

There are no removal and replacement procedures for the HP 98644A card.

ADJUSTMENTS

SECTION 7

There are no adjustment procedures for the HP 98644A card.

TROUBLESHOOTING

SECTION 8

SERVICE POLICY

In the event of a card failure, contact your nearest HP Sales and Service office for assistance. The system functional test for the card (see below) can help determine whether your card is working properly.

NOTE

Attempting component repair will void any warranty still in effect.

CARD VERIFICATION

A functional test for the 98644A card is included in the HP 9000 Series 200 System Functional Tests. The System Functional Tests are available in the following forms:

```
Part no. 09800-10334   System test (rev. C) on 3-1/2" (micro-floppy) disc
Part no. 09800-10534   System test (rev. C) on 5-1/4" (mini-floppy) disc
```

In addition, the test for the 98644A card requires a loopback connector, part number 98644-67950.

These parts are available through your HP Sales and Support office.

FUSES

The 98644A card is protected with three fuse traces, one each for the +5V, +12V, and -12V lines. Each trace is 0.5" long by 0.008" wide, and provides protection up to approximately 5 amperes.

REPLACEABLE PARTS

SECTION 9

This section contains information for ordering replaceable parts for the 98644A card. Table 9-1 contains a list of replaceable parts and table 9-2 contains the names and addresses of the manufacturers indexed by the code numbers in table 9-1. The locations of the parts on the 98644A card are shown in figure 12-15, at the end of Section 12.

REPLACEABLE PARTS

Table 9-1 contains a list of replaceable parts in reference designation order. The following information is listed for each part:

1. Reference designation of the part.
2. The Hewlett-Packard part number.
3. Part number check digit (CD).
4. Total quantity.
5. Description of the part.
6. A five-digit manufacturer's code number for a typical manufacturer of the part. Refer to table 9-2 for a cross-reference of the manufacturers.

ORDERING INFORMATION

To order replacement parts or to obtain information on parts, address the order or inquiry to the nearest Hewlett-Packard Sales and Support Office (Sales and Support Offices are listed at the back of this manual).

To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number (with the check digit), and indicate the quantity required. The check digit will ensure accurate and timely processing of your order.

To order a part that is not listed in the replaceable parts table, specify the following information:

1. Identification of the kit containing the part (refer to the product identification information supplied in Chapter 1).
2. Description and function of the part.
3. Quantity required.

Table 9-1. HP 98644A Replaceable Parts

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
	98644-66502	4	1	PCA DIO LOW COST	28480	98644-66502
C1	0180-0228	6	3	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
C2	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
C3	0160-3847	9	8	CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
C4	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
C5	0160-4810	8	4	CAPACITOR-FXD 330PF +-5% 100VDC CER	28480	0160-4810
C6	0160-4810	8		CAPACITOR-FXD 330PF +-5% 100VDC CER	28480	0160-4810
C7	0160-4810	8		CAPACITOR-FXD 330PF +-5% 100VDC CER	28480	0160-4810
C8	0160-4810	8		CAPACITOR-FXD 330PF +-5% 100VDC CER	28480	0160-4810
C9	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
C10	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
C11	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
C12	0160-4833	5	1	CAPACITOR-FXD .022UF +-10% 100VDC CER	28480	0160-4833
C13	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
C14				NOT ASSIGNED		
C15	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
C16	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
C17	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
CR1	1901-1098	1	2	DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
CR2	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
J1	1252-0269	9	1	CONN-RECT D-SUBMIN 25-CKT 25-CONT	28480	1252-0269
R1				NOT ASSIGNED		
R2				NOT ASSIGNED		
R3	0683-1525	4	2	RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
R4	0683-1525	4		RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
SW1	3101-2763	5	1	SWITCH-SL 10-1A DIP-SLIDE-ASSY .1A 30VDC	28480	3101-2763
U1-U22				NOT ASSIGNED		
U23	1820-1201	6	1	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
U24	1820-0390	8	2	IC RCVR DTL NAND LINE QUAD	01295	SN75189AJ
U25	1820-0390	8		IC RCVR DTL NAND LINE QUAD	01295	SN75189AJ
U26-U31				NOT ASSIGNED		
U32	1820-0509	5	1	IC DRVR DTL LINE DRVR QUAD	04713	MC1488L
U33	1820-2443	0	1	IC UART	28480	1820-2443
U34				NOT ASSIGNED		
U35	1820-1416	5	1	IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
U36-U50				NOT ASSIGNED		
U51	1820-1438	1	1	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS257AN
U52				NOT ASSIGNED		
U53	1810-0162	5	1	NETWORK-RES 14-DIP4.7K OHM X 13	11236	760-1-R4.7K
U54	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
U55				NOT ASSIGNED		
U56	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
U57-U60				NOT ASSIGNED		
U61	1820-1491	6	1	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
U62	1820-1297	0	2	IC GATE TTL LS EXCL-NOR QUAD 2-INP	01295	SN74LS266N
U63				NOT ASSIGNED		
U64	1820-1449	4	1	IC GATE TTL S OR QUAD 2-INP	01295	SN74S32N
U65	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
U66	1820-1195	7	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
U67-U70				NOT ASSIGNED		
U71	1820-2075	4	1	IC TRANSCEIVER TTL LS BUS OCTL	28480	1820-2075
U72	1820-0681	4	1	IC GATE TTL S NAND QUAD 2-INP	01295	SN74S00N
U73				NOT ASSIGNED		
U74	1820-1195	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
U75	1820-1568	8	1	IC BFR TTL LS BUS QUAD	01295	SN74LS125AN
U76	1820-1427	8	1	IC DCDR TTL LS 2-TO-4-LINE DUAL 2-INP	01295	SN74LS156N

Table 9-1. HP 98644A Replaceable Parts (continued)

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
U77-						
U82				NOT ASSIGNED		
U83	1820-1297	0		IC GATE TTL LS EXCL-NOR QUAD 2-INP	01295	SN74LS266N
Y1	1813-0202	0	1	CLOCK-OSCILLATOR-XTAL 2.4576-MHZ 0.01%	28480	1813-0202
	0515-0076	3	2	SCREW-MACH M3 X 0.5 6MM-LG 90-DEG-FLH-HD	28480	0515-0076
	98644-00001	0	1	I/O COVER PLATE	28480	98644-00001
	0590-1445	0	2	THREADED INSERT-NUT M3 X 0.5 CARB-STL	28480	0590-1445
	98644-26502	0	1	BOARD ETCHED	28480	98644-26502

Table 9-2. Code List of Manufacturers

Mfr Code	Manufacturer Name	Address		Zip Code
S4013	HITACHI	TOKYO, JAPAN		
01121	ALLEN-BRADLEY CO	MILWAUKEE	WI	53204
01295	TEXAS INSTR INC SEMICOND COMPNT DIV	DALLAS	TX	75222
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX	AZ	85008
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW	CA	94042
11236	CTS OF BERNE INC	BERNE	IN	46711
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD	PA	16701
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO	CA	94304
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS	MA	01247
9N171	UNITRODE CORP	LEXINGTON	MA	

REFERENCE

SECTION 10

There is no reference information for the HP 98644A card.

PRODUCT HISTORY

SECTION 11

COMPARISON OF 98644-66502 AND 98644-66501

The current version of the 98644A serial interface card (card assembly number 98644-66502, date code A-2505) replaces previous versions of the card (all with a card assembly number of 98644-66501).

(The old card is described in manual 98644-90001.)

The primary differences between the 98644-66502 and 98644-66501 cards are:

1. Jumpers on the -66501 card have been replaced by switches on the -66502 card.
2. The oscillator circuit has changed.

Jumpers

The REMOTE jumper on the -66501 card has been replaced by switch 1 of switch pack SW1 on the -66502 card.

The 626 OPT jumper on the -66501 card has been replaced by switch 2 of switch pack SW1.

The factory settings of the new switches on the -66502 card yield the same results as the factory configuration of the jumpers on the -66501 card.

Clock Circuit

The clock circuit on the -66501 card consisted of:

resistors R1 and R2, 1.5 K-ohms each
capacitor C14, 330 pF
two inverters, part of IC U35
crystal Y1

On the -66502 card these have all been replaced by a crystal oscillator package, also designated as Y1. Resistors R1 and R2 have been removed from the card, as has capacitor C14. Inverter circuits U35B and U35D have been tied to ground.

Other Changes

Capacitor C17 (.01 uF) has been added to the -66502 card to aid in decoupling the power supply. This capacitor did not appear on the -66501 card.

The earliest version of the -66501 card (revision C-2430) used machine screws to mount the RS-232-C connector to the card. This connector was changed to a solder-mount type for later versions of the -66501 card (starting with revision C-2445) and continuing with the -66502 card.

COMPARISON OF 98644A AND 98626A

The 98644A serial interface card is similar in function to the 98626A card, and can replace the 98626A card in many applications. Differences between the current version of the 98644A card (98644-66502, date code A-2505) and the 98626A card are as follows:

HARDWARE DIFFERENCES

Optional Drivers/Receivers

The 98626A card provides two optional drivers (OCD3 and OCD4) and two optional receivers (OCR2 and OCR3) which can be accessed with Control/Status calls. The 98644A design does not provide these lines.

Physical Connection

The 98644A provides a 25 pin D-type female connector rather than the 50-pin connector found on the 98626A. Because of the standard connector on the new card, cables are not provided with the 98644A product. Standard RS-232-C cables can be purchased from your HP Sales and Sevice office or from the HP Computer Supplies Operation.

The new connector does not support either the HP 13265A modem or the HP 13266A Current-loop Interface. These peripherals require the 50-pin connector which brings backplane supply voltages through the cable. The 98644A does not provide any power supply voltages.

Switches and Jumpers

The 98626A has five switch packs and one jumper, with the following functions:

Switch Packs
Baud Rate
Line Control
Select Code
Interrupt Level
Status Line Disconnect

Jumper
Remote Keyboard Enable

These functions have been mapped into the 98644A's switches as follows:

Baud Rate, Line Control	These switch packs were removed from the 98644A, and their parameters must now be set in software with Control statements. (The ability to perform software configurations exists with the 98626A drivers also, with the default parameters being those which were set on the hardware switches. The defaults for the 98644A are undefined.)
Select Code	On the 98644A, the select code is set by switches 6-10 of switch pack SW1.

Interrupt Level	On the 98644A, the interrupt level is set by switches 4 and 5 of switch pack SW1.
Status Line Disconnect	The four lines controlled by this switch pack (CTS, DSR, RI, and CD) are all controlled by switch 3 of switch pack SW1 on the 98644A card. The lines can not be set individually; they are either all strapped low or all connected to their respective pins on the connector.
Remote Keyboard Enable	This function is handled by switch 1 of switch pack SW1 on the 98644A.

In addition to the above functions, the 98644A has another switch (switch 2 of switch pack SW1) that allows for changing the secondary ID of the 98644A to look like that of the 98626A.

Section 3 of this manual tells how to set the switches on the 98644A

Registers

Hardware register #5 on the 98626A is a read/write register for controlling the optional drivers (OCD3, OCD4), reading the optional receivers (OCR2, OCR3), and reading the hardware baud rate select switch.

Since the 98644A has none of these hardware features, register #5 does not exist. To avoid a bus error, the address for register #5 maps into the address for register #1 (Interrupt Register). (Incidentally, software register #7 maps to hardware register #5.)

Hardware register #7 on the 98626A is a "read only" register which returns the setting of the line control switch. This switch is not provided on the 98644A (as described above); consequently register #7 does not exist. To avoid a bus error, the address for register #7 maps to the address for register #3.

SOFTWARE DIFFERENCES

Card ID

The ID number for I/O cards provides the Boot ROM and the operating system with the method for identifying the type of cards present on the backplane. The ID is a 7 bit number; five bits are used for the primary ID, two for the secondary ID.

The primary ID for both the 98644A and the 98626A is 2. The secondary ID for the 98644A is 2; the secondary ID for the 98626A is 0. The different secondary IDs have results as explained in the following paragraphs.

Boot ROMs

Upon system power-up, the Boot ROM polls the backplane to identify which devices are present. The findings are listed on the left side of the CRT screen.

Boot ROM 3.0 and earlier will recognize the 98644A as a 98626A because the upper bits of the ID register are masked. Boot ROM 4.0 will recognize the 98644A as a 98644A.

BASIC Operating Systems

BASIC 2.1 and earlier will recognize the 98644A as a 98626A and will attach the 98626A serial driver.

If the 98644A is being used in an application written for the 98626A, the operator must be aware of the hardware changes. That is, datacomm parameters must now be set in software; lines OCD3, OCD4, OCR2 and OCR3 cannot be used. If hardware registers #5 and #7 are accessed, the data will be meaningless.

BASIC 3.0 contains a driver written specifically for the 98644A.

Pascal Operating Systems

Pascal systems 2.1 and earlier will not recognize the 98644A since the system reads the entire ID register (the secondary ID bits are not masked out). Consequently, Pascal will not assign a driver to the card.

In order to use Pascal 2.1 and earlier, switch 2 on switch pack SW1 of the 98644A allows for setting the secondary ID to a value of 0, making the card appear to be a 98626A. Again, if this option is elected, the operator must be aware of the hardware differences between the two cards. (Pascal 3.0 contains a driver written specifically for the 98644A.)

HP-UX Operating Systems

HP-UX 2.0 will not recognize the 98644A. To overcome this barrier, switch 2 on switch pack SW1 may be used as described in the preceding paragraph. Later versions of the HP-UX operating system contain a driver for the 98644A. Consult the system documentation.

DIAGRAMS

SECTION 12

REGISTER MAPS

The register maps that follow show the meanings of the bits in the various registers on the 98644A card. You may find these maps useful if you are doing direct access to the registers on the card. Generally, you will use these calls to read from and write to registers directly:

In Pascal: IOREAD_BYTE and IOWRITE_BYTE
In BASIC: READIO and WRITEIO

Brief examples of the general approach to direct register access are given in Appendix A of this manual. For more information on direct register access, refer to the Programming Techniques manual or Interfacing Techniques manual for the operating system that you are using on your computer.

Note that with several registers READ and WRITE operations access different sets of bits.

Register 1: Interface Reset and ID

READ from Register 1

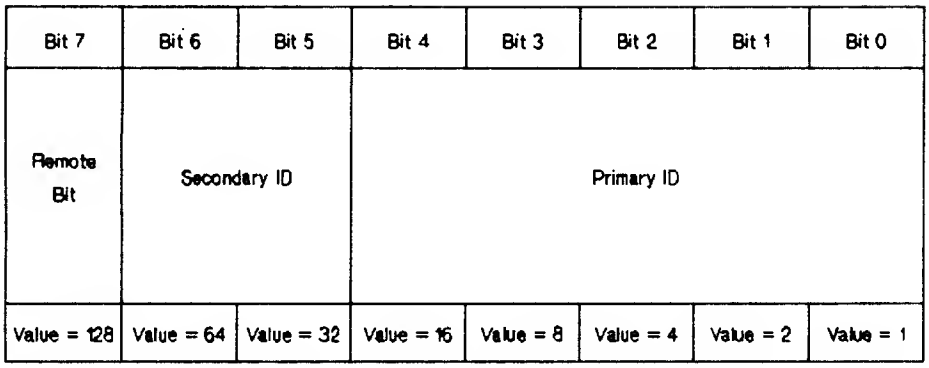


Figure 12-1. READ from register 1

Bit 7 **Remote.** This bit echoes the setting of the remote switch (switch 1 of switch pack SW1).

```
0 = remote keyboard disabled
1 = remote keyboard enabled
```

Bits 6 & 5 **Secondary ID.** This is the secondary ID of the card. It can be either 0 (= 98626A card) or 2 (= 98644A card), depending on the setting of switch 2 of switch pack SW1.

Bits 4 - 0 **Primary ID.** This is the primary ID of the card. This value is hardwired to 2.

WRITE to Register 1

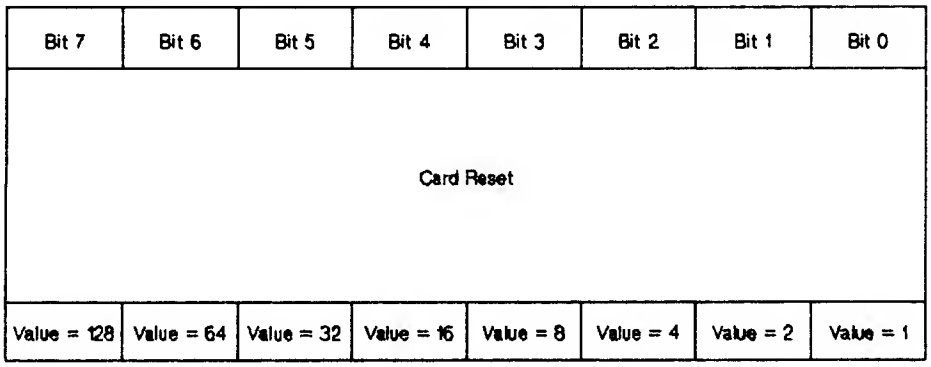


Figure 12-2. WRITE to register 1

Any write to register 1 resets the card.

Register 3: Interrupt Control

Bit 7 of this register is a read/write bit. Bits 6 through 4 are read-only bits.

READ from Register 3

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Interrupt Enable	Interrupt Status	Interrupt Level		(not used)			
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Figure 12-3. READ from register 3

Bit 7 **Interrupt Enable.** This bit must be set to 1 for the card to be able to generate interrupts.

```
0 = interrupts are not enabled
1 = interrupts are enabled
```

Bit 6 **Interrupt Status.**

```
0 = no interrupt requests pending
1 = interrupt request is pending
```

Bits 5 & 4 **Interrupt Level.**

```
00 = interrupt level 3
01 = interrupt level 4
10 = interrupt level 5
11 = interrupt level 6
```

WRITE to Register 3

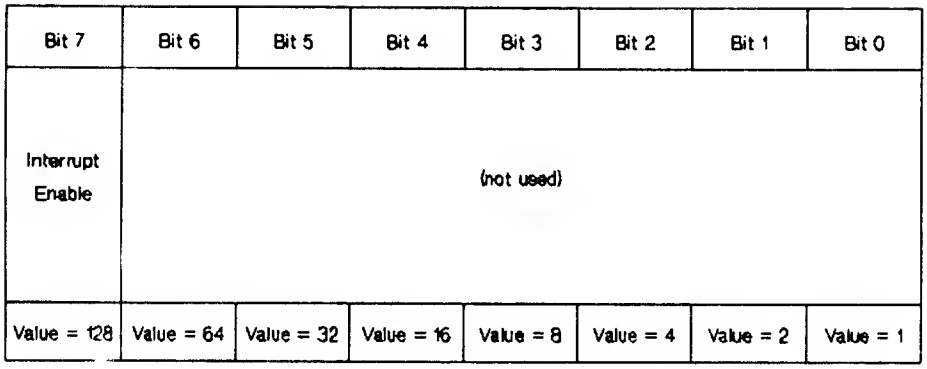


Figure 12-4. WRITE to register 3

Bit 7 **Interrupt Enable.**

```
0 = disable the card from interrupting
1 = enable the card to interrupt
```

Registers 5 and 7

Registers 5 and 7 map directly into registers 1 and 3, respectively. These registers are provided to minimize incompatibilities between the 98644A card and the 98626A card. Software written for the 98626A that accesses these registers will not generate I/O errors, but the results might not be what you expect. Any reads from register 5 or 7 will actually return values from register 1 or 3, and any writes to register 5 or 7 will actually place values in register 1 or 3.

Register 17: Receiver Buffer and Transmitter Holding Register

Register 17 has different meanings depending on the setting of bit 7 of register 23. When that bit is set to 0, register 17 acts as a buffer for incoming and outgoing data, as shown in the next two diagrams. When that bit is set to 1, register 17 is the lower byte of the baud rate divisor, as described later.

The receiver and transmitter are double buffered. When the transmitter shift register becomes empty, a character is transferred from the holding register to the shift register. You can then place a new character in the holding register (WRITE) while the preceding character is being transmitted. Incoming characters are transferred to the receiver buffer when the receiver shift register becomes full. You can then input the character (READ) while the next character is being constructed in the shift register.

Reg. 23 READ from Register 17

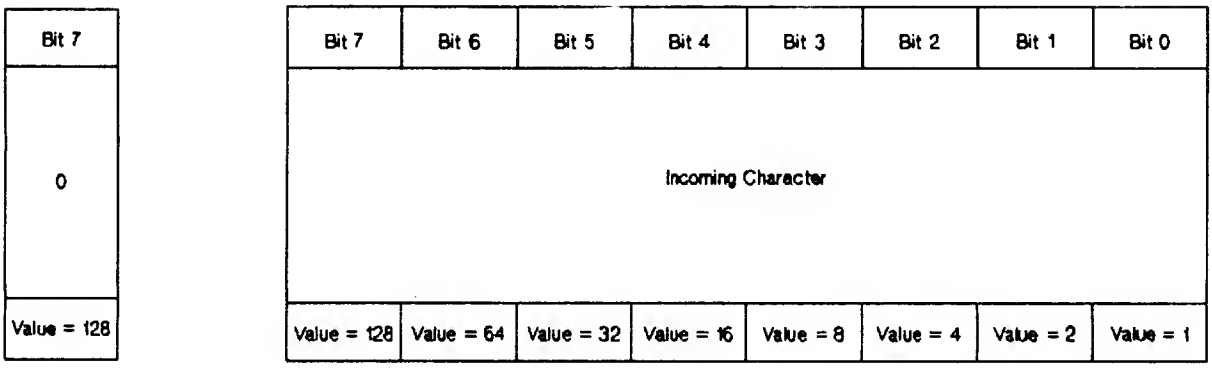


Figure 12-5. READ from register 17 with bit 7 of register 23 clear

This register contains the character to be read.

Reg. 23 WRITE to Register 17

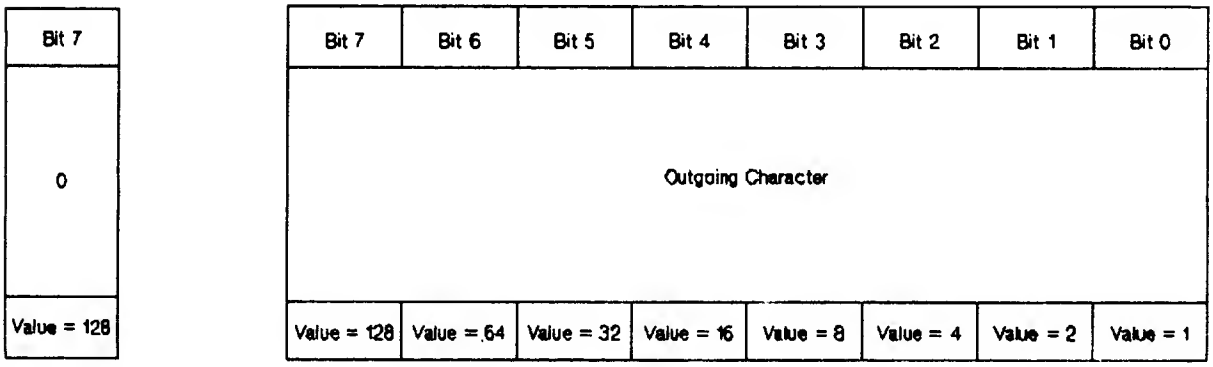


Figure 12-6. WRITE to register 17 with bit 7 of register 23 clear

This register receives the character to be written.

Registers 17 and 19: Baud Rate Divisor Latch

The meanings of registers 17 and 19 depend on the setting of bit 7 of register 23. When that bit has a value of 0, the meanings are as described immediately before (register 17) and after (register 19) this description. When that bit has a value of 1, registers 17 and 19 combine to form the baud rate divisor. The baud rate set for the card has a value of:

153600 / baud rate divisor

The baud rate divisor is a 16-bit integer. When bit 7 of register 23 is set to 1, register 19 contains the 8 most significant bits of the divisor and register 17 contains the 8 least significant bits.

For example, to set a baud rate of 300 baud, you would set the baud rate divisor to 512. This breaks down to the following bits:

```
Register 19: 00000010
Register 17: 00000000
```

Thus, to set the baud rate you would set bit 7 of register 23 to 1 and then write a value of 2 to register 19 and a value of 0 to register 17.

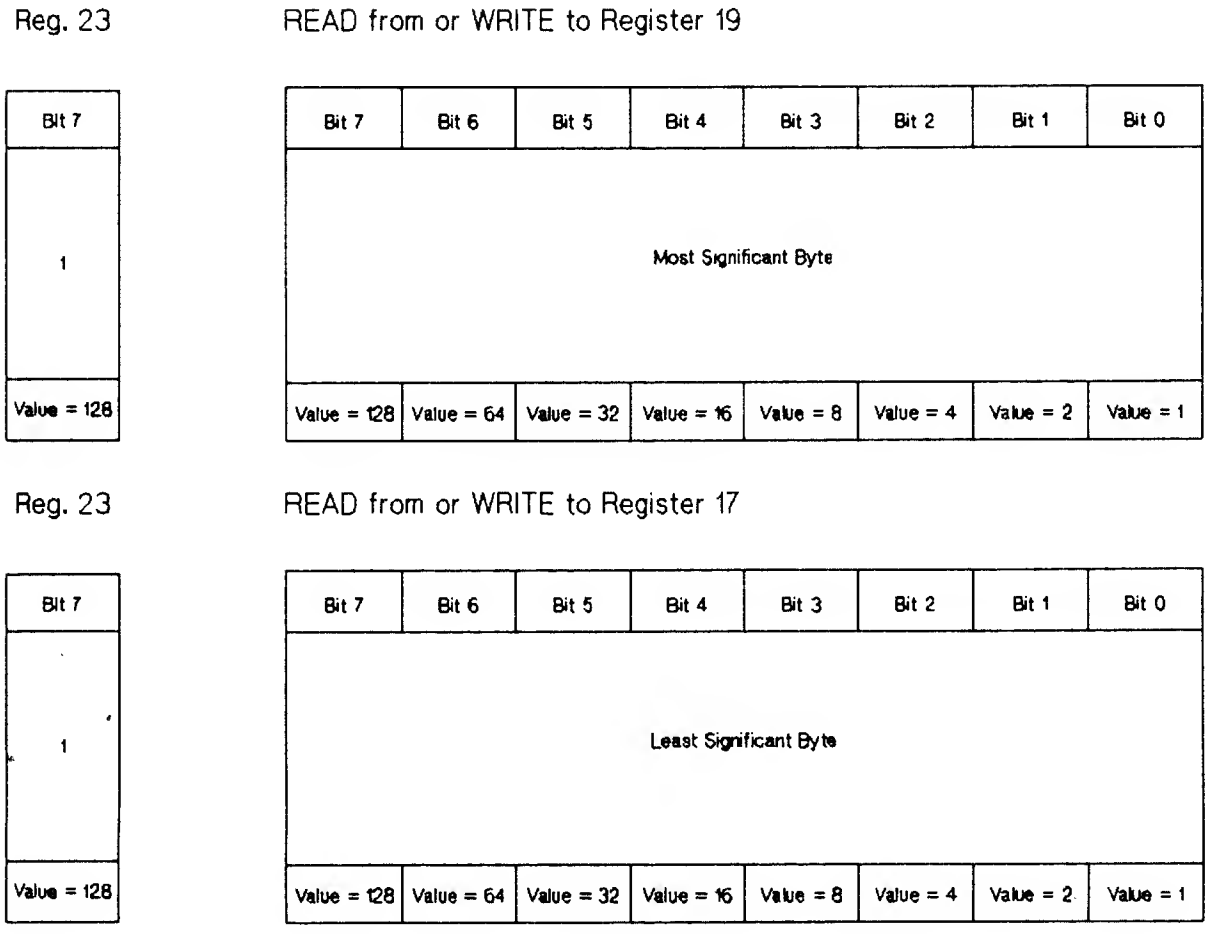


Figure 12-7. READ from and WRITE to registers 17 and 19 with bit 7 of register 23 set

Register 19: Interrupt Enable

Register 19 has different meanings depending on the setting of bit 7 of register 23. When that bit is set to 1, register 19 is part of the baud rate divisor latch, as described immediately above. When that bit is set to 0, register 19 enables the card to interrupt when specified conditions occur. Meanings of the individual bits in register 19 are:

Reg. 23 READ from or WRITE to Register 19

Bit 7
0
Value = 128

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
(not used)				Enable Modem Status Change Interrupts	Enable Receiver Line Status Interrupts	Enable Transmitter Holding Register Empty Interrupts	Enable Receiver Buffer Full Interrupts
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Figure12-8. READ from and WRITE to register 19 with bit 7 of register 23 clear

Bit 3 **Enable Modem Status Change Interrupts.** Setting this bit to 1 enables an interrupt whenever a modem status line changes state, as indicated by bits 0 through 3 of register 29.

Bit 2 **Enable Receiver Line Status Interrupts.** Setting this bit to 1 enables interrupts by errors or received BREAKs, as indicated by bits 1 through 4 of register 27.

Bit 1 **Enable Transmitter Holding Register Empty Interrupts.** Setting this bit to 1 enables interrupts when bit 5 of register 27 is also set to 1.

Bit 0 **Enable Receiver Buffer Full Interrupts.** Setting this bit to 1 enables interrupts when bit 0 of register 27 is also set to 1.

Register 21: Interrupt Identification

This register indicates whether an interrupt is currently pending and, if so, identifies the cause of the highest priority interrupt currently pending.

READ from Register 21

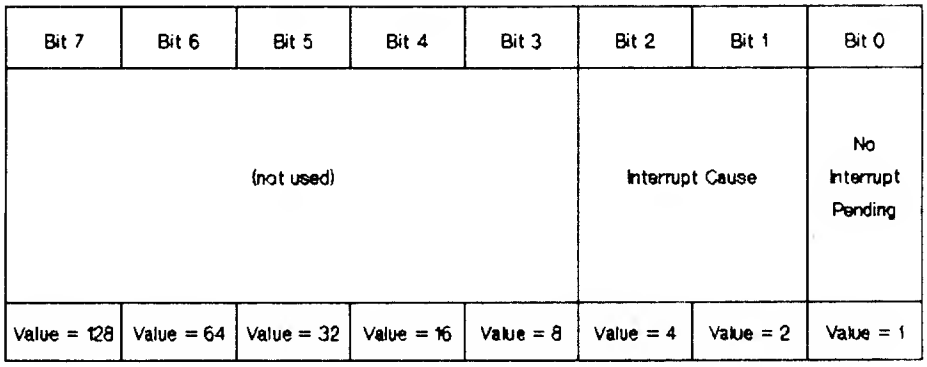


Figure 12-9. READ from register 21

Bits 2 & 1 **Interrupt Cause.** Causes of interrupts are:

11 = Receiver Line Status interrupt (highest priority) is caused when bit 2 of register 19 is set to 1 and a framing error, parity error, overrun error, or BREAK is detected by the receiver (as indicated by bits 1 through 4 of register 27). To clear the interrupt, read register 27.

10 = Receive Buffer Register Full interrupt is caused when bit 0 of register 19 is set to 1 and the data ready bit (bit 0) of register 27 is set to 1. To clear the interrupt, read the receiver buffer (register 17 when bit 7 of register 23 is set to 0) or write a zero to bit 0 or register 27.

01 = Transmitter Holding Register Empty interrupt occurs when bit 1 of register 19 is set to 1 and bit 5 of register 27 is set to 1. To clear this interrupt, write data into the transmitter holding register (register 17 when bit 7 of register 23 is set to 0) or read this register (register 21).

00 = Modem Line Status Change interrupt is caused when bit 3 of register 19 is set to 1 and one or more of bits 0 through 3 of register 29 is also set to 1. To clear this interrupt, read register 29. (This also clears those status change bits.)

Bit 0 **No Interrupt Pending.**

0 = interrupt is pending
1 = no interrupt pending

Register 23: Character Format Control

A READ from this register returns the current character format setting; a WRITE sets a new character format.

READ from or WRITE to Register 23

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Divisor Latch Access Bit	Set BREAK	Parity Sense		Parity Enable	Stop Bits	Character Length	
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Figure 12-10. READ from or WRITE to register 23

Bit 7 **Divisor Latch Access Bit.** When set to 1, this bit allows you to access the divisor latch of the baud rate generator. This latch comprises registers 19 and 17.

Bit 6 **Set BREAK.** This bit, when set to 1, holds the serial line in a BREAK state (always zero), independent of other transmitter activity. **This bit must be cleared to disable the BREAK and to resume normal activity.**

Bits 5 & 4 **Parity Sense.**

```
00 = ODD parity
01 = EVEN parity
10 = always ONE
11 = always ZERO
```

Bit 3 **Parity Enable.** When this bit is set to 1, the card sends a parity bit with each outgoing character, and checks all incoming characters for parity errors. Parity sense is defined by bits 5 and 4 of this register.

Bit 2 **Stop Bits.** Stop bits are defined by a combination of bit 2 and bits 1 and 0 (character length bits).

Bit 2	Character Length	Stop Bits
0	5, 6, 7, or 8	1
1	5	1.5
1	6, 7, or 8	2

Bits 1 & 0 **Character Length.**

```
00 = 5 bits
01 = 6 bits
10 = 7 bits
11 = 8 bits
```

Register 25: Modem Control

A READ operation returns the current value of this register. A WRITE operation sets a new value for the register.

READ from or WRITE to Register 25

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
(not used)			Loopback	Data Rate Select	(not used)	Request to Send	Data Terminal Ready
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Figure 12-11. READ from or WRITE to register 25

Bit 4 **Loopback.** Setting this bit to 1 enables a loopback feature for diagnostic testing. The serial line is set to the MARK state, the UART receiver is disconnected, and the transmitter output shift register is connected to the receiver input shift register. Modem line outputs and inputs are connected as follows: DTR to CTS, RTS to DSR, DRS to DCD, and SRTS to RI. Interrupts are enabled, with interrupts caused by modem control outputs instead of inputs from the modem.

Bit 3 **Data Rate Select.** This bit controls the OCD1 driver output.

```
0 = active
1 = disabled
```

Bit 1 **Request to Send.** This bit controls the RTS modem control line:

```
0 = RTS is toggled by output operations
1 = RTS is always active
```

Bit 0 **Data Terminal Ready.** This bit controls the DTR modem control line.

```
0 = DTR is controlled by input and output operations
1 = DTR is always active
```

Register 27: Line Status

READ from Register 27

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
(not used)	Transmitter Shift Register Empty	Transmitter Holding Register Empty	Break Indicator	Framing Error	Parity Error	Overrun Error	Data Ready
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Figure 12-12. READ from register 27

Bit 6 **Transmitter Shift Register Empty.** When set to 1, this bit indicates no data present in the transmitter shift register.

Bit 5 **Transmitter Holding Register Empty.** When set to 1. this bit indicates no data present in the transmitter holding register. This bit is cleared to 0 whenever a new character is placed in the register.

Bit 4 **Break Indicator.** When set to 1, this bit indicates that the received data input remained in the spacing (line idle) state for longer than the transmission time of a full character frame. This bit is cleared to 0 whenever this register is read.

Bit 3 **Framing Error.** When set to 1, this bit indicates that a character was received with improper framing. (That is, the start and stop bits did not conform with expected timing boundaries.)

Bit 2 **Parity Error.** When set to 1, this bit indicates that the received character did not have the expected parity sense. This bit is cleared to 0 when this register is read.

Bit 1 **Overrun Error.** When set to 1, this bit indicates that a character was destroyed because it was not read from the receiver buffer before the next character arrived. This bit is cleared to 0 when this register is read.

Bit 0 **Data Ready.** When set to 1, this bit indicates that a character has been placed in the receiver buffer register. This bit is cleared to 0 by reading the receiver buffer register or by writing a zero to this bit.

Register 29. Modem Status

READ from Register 29

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Data Carrier Detect	Ring Indicator	Data Set Ready	Clear to Send	Change in Carrier Detect	Trailing Edge of Ring Indicator	Change in Data Set Ready	Change in Clear to Send
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Figure 12-13. READ from register 29

Bit 7 **Data Carrier Detect.** When set to 1, this bit indicates that the DCD modem line is active.

Bit 6 **Ring Indicator.** When set to 1, this bit indicates that the RI modem line is active.

Bit 5 **Data Set Ready.** When set to 1, this bit indicates that the DSR modem line is active.

Bit 4 **Clear to Send.** When set to 1, this bit indicates that the CTS modem line is active.

Bit 3 **Change in Carrier Detect.** When set to 1, this bit indicates that the DCD modem line has changed state since the last time this register was read.

Bit 2 **Trailing Edge of Ring Indicator.** This bit is set to 1 when the RI modem line changes from active to inactive state.

Bit 1 **Delayed Data Set Ready.** This bit is set to 1 when the DSR modem line has changed state since the last time this register was read.

Bit 0 **Change in Clear to Send.** When this bit is set to 1, it indicates that the CTS modem line has changed since the last time this register was read.

CONNECTOR DIAGRAM

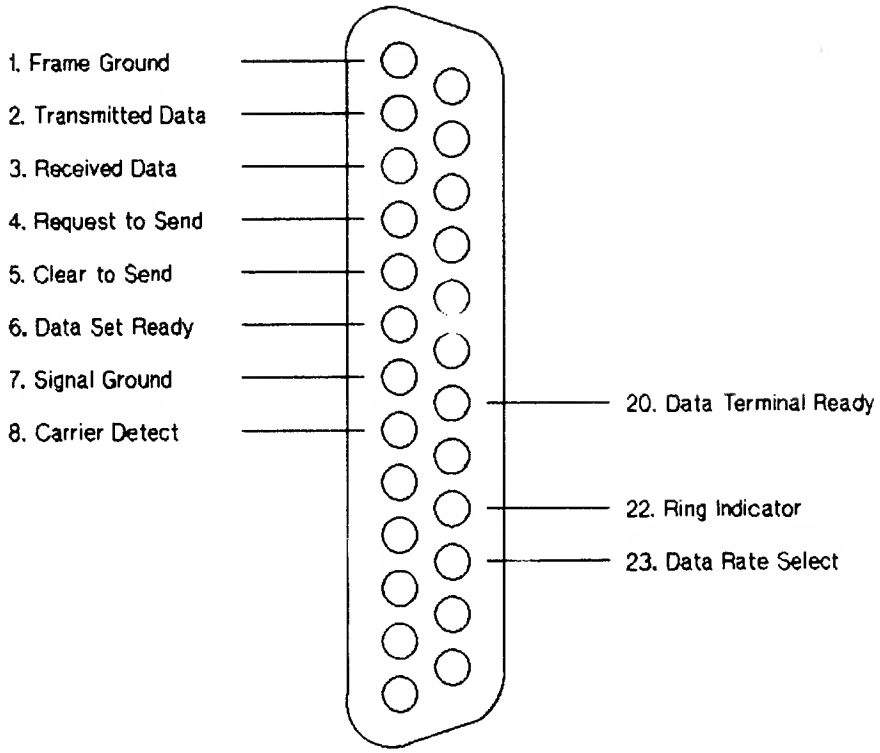


Figure 12-14. RS-232-C connector wiring, 98644-66502 card

PARTS LOCATION DIAGRAM

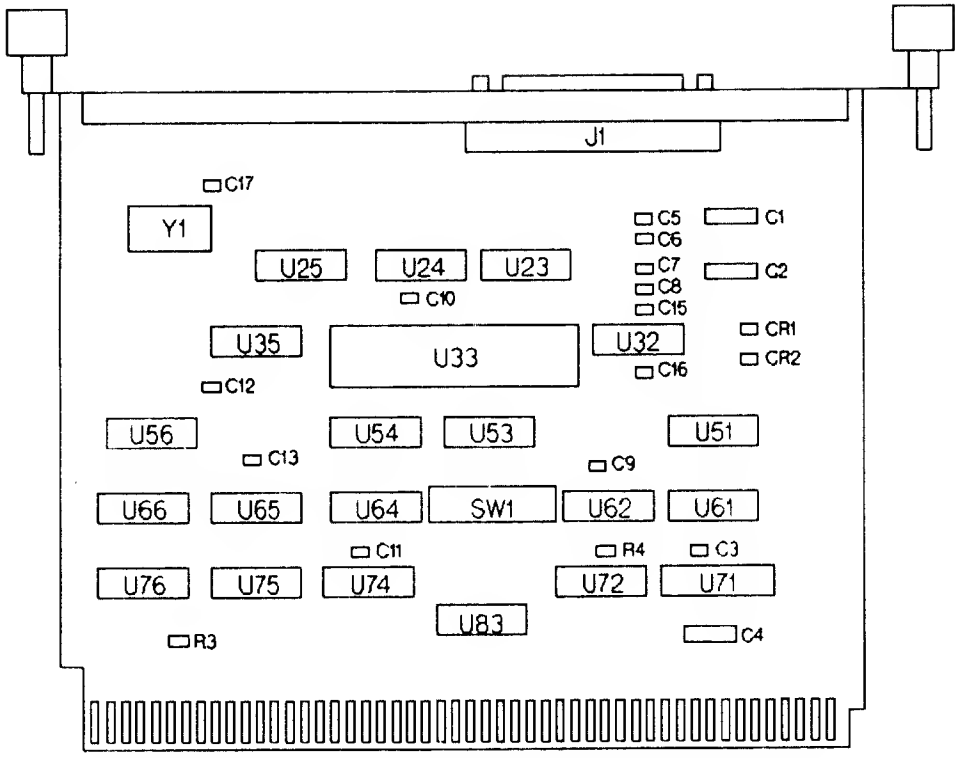


Figure 12-15. Parts location, 98644-66502 card

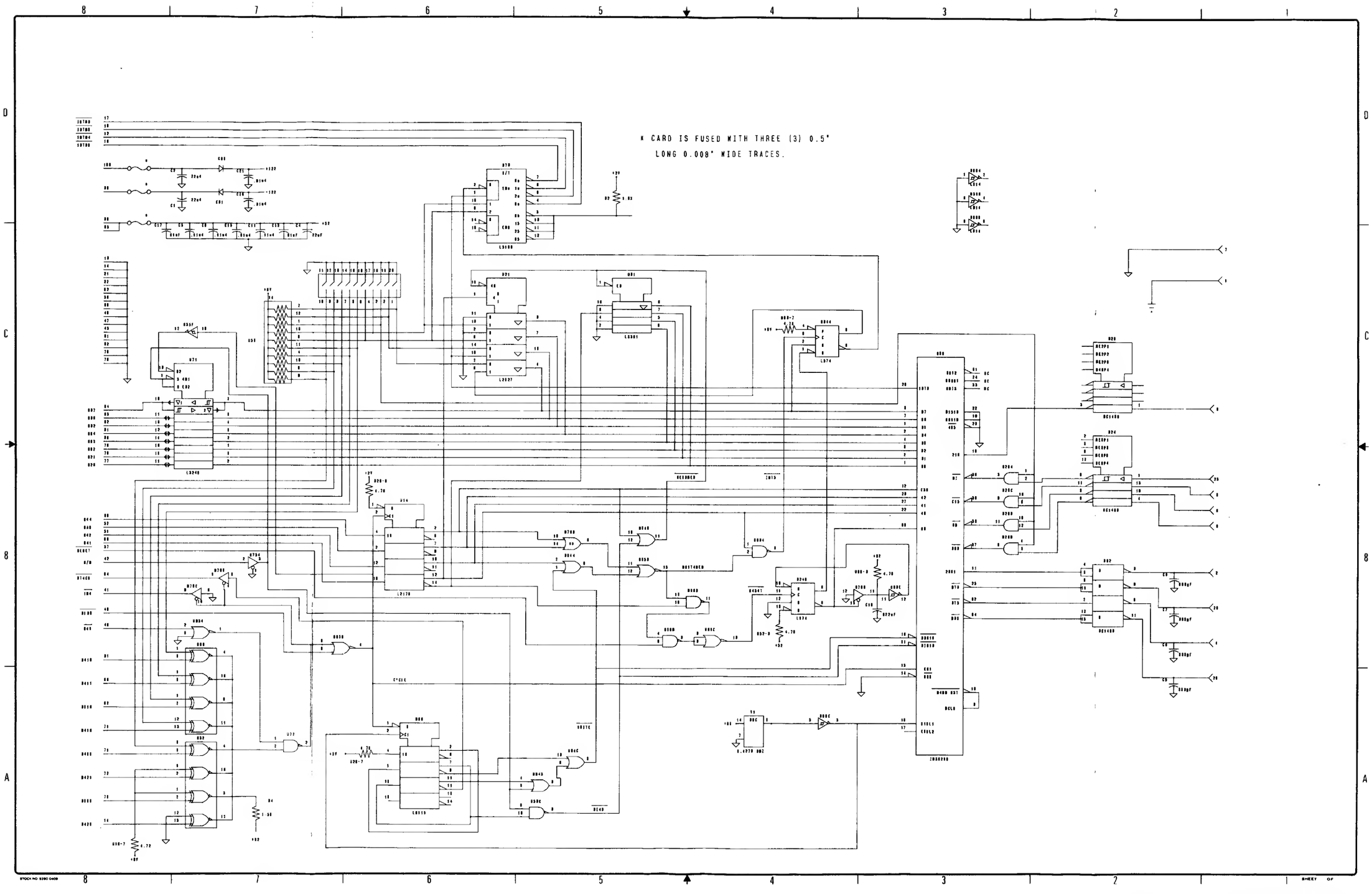


Figure 12-1. Schematic Diagram, 98644-66502

PROGRAMMING

APPENDIX
A

You can access the registers on the 98644A card either directly or through the driver. Access through the driver is generally less cumbersome (it's a higher level operation). Driver access is made with the following calls:

In Pascal: IOSTATUS and IOCONTROL
In BASIC: STATUS and CONTROL

For information on driver-level programming of the 98644A card, refer to the Programming Techniques manual or Interfacing Techniques manual for the operating system that you are using on your computer.

You may want (or need) to access the registers directly. Direct register access is made with the following calls:

In Pascal: IOREAD_BYTE and IOWRITE_BYTE
In BASIC: READIO and WRITEIO

If you are accessing the registers on the 98644A card directly, the register maps in Section 12 (Diagrams) of this manual should prove useful. Note that the register numbers you use for driver access and the ones you use for direct access are not the same. (See your Programming Techniques or Interfacing Techniques manual for details.) Note also that mixing driver access calls and direct access calls can lead to unexpected results. Use care and check your programming manual.

READER COMMENT SHEET

HP DIRECT I/O Computer Systems

HP 98644A ASYNCHRONOUS SERIAL INTERFACE
Reference Manual

98644-90002 March 1985

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